Meeting Minutes

for the 8th experts meeting of IHRA pedestrian protection
5-8 Feb. 2001, Stamford Hotel, Adelaide, Australia

Day 1 (Mon. 1 Feb.) Stamford Hotel

1. Opening of the meeting

The chairperson, Mr. Mizuno opened the meeting at 9:30 beginning with an expression of appreciation for the efforts Mr. McLean extended in making the necessary arrangements for the meeting. Mr. Mizuno noted that a public hearing on pedestrian protection in the EU had reduced the number of EU experts in attendance. The chairperson encouraged active participation from those present and asked for their positive contributions in finalizing at least a draft of procedures for head tests.

2. Roll call of delegates

(See attached sheet Appendix 1)

3. Adoption of meeting agenda

The draft agenda was approved with minor changes.

- Changes:

Japan's "Ministry of Transport"
changed to "Ministry of Land, Infrastructure and Transport"
AAM: Mr. Bilkhu - absent
Item 8: WG 2001 Report is to be discussed on the 4th day.

The participants agreed to discuss requirements for the "Summary", including writing style, deadline, etc., after Ms. Brun-Cassan joined the meeting on the afternoon of the 1st day.

Mr. Saul announced that he is scheduled to leave his post and will not be participating in future meetings. A successor has not yet been appointed.

4. Approval of draft minutes from the 5th Meeting

- Change the last line of page 7 to read:

Mr. Saul also introduced a resonance problem discovered in the specified Endevco accelerometer in processing the child headform test.

- Change ***HIC35*** of ***conclusion 14*** to read:

HIC36 = 1000

- Change the 13th line of page 12 to read:

He further requested that dashboards also be included,…..

5. IHRA Steering Committee Report

Mr. Mizuno announced that Mr. Owings of NHTSA offered to make a presentation at the next WP29 to explain the steering committee's unanimous understanding that IHRA output will be applied as the basis of future global technical regulations under the 98 Agreements.

He also reported that member states except the EU have submitted critical reports to the IHRA steering committee, and suggested that WGs should be continued since nearly all WG are still in progress.

6. Test procedures

1. General

Mr. Saul proposed that the diagrams on the "Number of pedestrian injuries related to contact location and body region for the USA, Japan, and Europe" originally entered as Figure 31a, 31b, and 31c be re-titled Chapter 4, Table 4.3, 4.5, and 4.6 respectively. (IHRA/PS/179)

Mr. Mizuno raised the question of how to handle the accident study results expected from Australia.

Data from the US, Japan, and Germany have been combined as global data for the report to ESV Conference, and there is insufficient time to realign the data to include the delayed Australian figures. Consequently, delegates are to compile their assigned chapters providing due consideration for the Australian data.

Final result on vehicle front shape

Mr. Ishikawa presented an analysis on "Car Front Shape Corridors" including a corridor for the area below the bumper for the categories of "Sedan + Light vehicle + Sports", "SUV", and "One-Box".

He stated that, while all 33 models he analyzed this time are Japanese, he later learned that the frontal shapes of European, Australian, and AAM models all correspond to the same corridor.

Another delegate asked if he had included the window angle and length. Mr. Ishikawa replied that these factors were not included because of the difficulties presented by working with line data only.
Mr. Lawrence asked if a simplified linear corridor could be drawn up.
Mr. Ishikawa said that it could be compiled from digital data.
Mr. Lawrence suggested that the report include details of the diagram including a description, background information, purpose, and methods of application.

Definition of WAD

Mr. Lawrence proposed a definition for WAD as discussed at the last meeting. The delegates agreed to amend the definition in the "Scope of Draft" as proposed.

CONCLUSION 1

For this test method "child" covers a range of statures, typically appropriate for children, but this range will also include some short adult.
Test method "adult" covers a range of statures, typically appropriate for adults, but this range will also include some tall children.

The delegates reconfirmed the use of "a straight line method" as appropriate for measurement, rather than the "contour method" used by NHTSA in the PEDS study. The choice was based on the assumption that the contour method would result in inaccurate WAD measurements for the windscreen. Material compiled for the contact point on the bonnet in the PEDS study will remain effective.

Targeted vehicle crash speed

Mr. Mizuno raised the question of whether a fixed vehicle speed or a range of speeds should be specified.
Mr. Lawrence and Mr. Saul proposed a range of 30-50km/h, to be left optional at the discretion of regulators in each nation who could specify a speed within the range since pedestrian accidents correspond to vehicle speed.
The industry delegates, however, requested a specified speed of up to 30km/h as adopted in the draft of ISO/TC22, claimed a realistic fixed speed from the perspective of vehicles feasibility.
A vote was held and the use of a speed range was chosen.
Mr. Mizuno suggested that the industry delegates propose that the 2001 report include their unified opinion concerning vehicle requirements as an OICA.

CONCLUSION 2

A target test speed of 30-50km/h is specified as the vehicle impact velocity for use in the adult/child head protection test procedures.

2. Adult head test procedure

Mr. Tanahashi announced an update the IHRA Draft to include provisions for a dynamic certification test and high speed impactor test as proposed by Mr. Janssen. (IHRA/PS/113R5)

In response to a proposal made by Mr. Lawrence, Mr. Tanahashi stated that the diagram would also be revised to show two separate WADs and angles for the bonnet and for the windscreen.

(a) Test tool

Headform mass and others

Mr. Ishikawa reported the completion of a parameter study with computer simulations as required by Conclusion 6 of the previous meeting. He elaborated by saying that the simulations were based on 27 cases of car front shapes classified in three categories; "Sedan", "SUV", and "One-Box".

He said that variations in head impact velocity, head impact angle, WAD and effective mass were investigated in contact simulations using the JARI model for bonnets and the NHTSA model for windows.

After describing the differences between the JARI and NHTSA models, Mr. Ishikawa pointed that both produced similar simulation results, noting the following factors:

1) Effective head mass is greatly influenced by impact conditions such as vehicle shape and stiffness.

2) The average value of effective head mass approaches the value of the head mass itself.

Mr. Lawrence suggested that the consequences of the average effective mass be used, appropriate measures considered for the worst case. He recommended that the static mass be used.

Mr. Anderson added that the mass of the neck should be taken into account.

Mr. Ishikawa, however, pointed out the difficulty in determining the effective mass of the neck joint.

Mr. Lawrence then suggested that JARI and NHTSA simulation results be applied to the Sedan class only.
As no agreement appeared to be in sight, Mr. Mizuno adjourned the first day session, asking the delegates to prepare their positions on the topic for renewed discussion in the following day's session.

Day 2 (Tues. 2 Feb.) Stamford Hotel

(b) Test procedure
Prior to renewing the previous day's discussion on the headform mass, the delegates addressed the issue of WAD in connection with adult headform tests, in compliance with a suggestion by Mr. McLean.

- Decision of impact area based on WAD

Mr. Saul, following ***the conclusion 10***, introduced WAD analysis based on U.S. PCDS data by which he tried to evaluate the effective transition zone for head impact test, focusing on what influence three parameters (impact velocity, stature and age) would have on WAD and the decisive elements for WAD. Through this analysis, Mr. Saul reached a conclusion that an increase in impact velocity led to an increase in WAD, and that velocity correlates closely with WAD.
He introduced the transition zone averaged by age and stature based on impact velocity. (IHRA/PS/186)
Mr. Tanahashi reported that he had classified the distribution of height and WAD in comparison with collision speed for increments of 10km/h
based on accident data for Japan in 1998, which includes all reported pedestrian casualties.
He showed a diagram of WAD distribution for a child and an adult based
on a formula reflecting the correlation of WAD and height at a specified collision speed. The boundary between a child (up to 15 years old) and an adult WAD was set at 150 cm.
Mr. Lawrence commented that the 170cm specified for US child WAD data is too high, and needs to be brought down, supposing the mass and height of a 6 year-old as representative of children. He suggested that criteria of stature should use both Japanese and American data, and that the WAD should be determined from the perspective of stature and age.
He added that impact speed is crucial in determining an effective WAD.

Mr. Ishikawa referred to a JARI investigation on the validity of the WAD definitions for adult and child used by EEVC/WG10 which proved to be similar to ours. The threshold for child WAD is 150cm and includes separate peaks for child and for adult, while our results show a WAD of 145cm.
He concluded that 150cm must be the optimum boundary (threshold), considering the different impactors for child and adult.
Mr. Lawrence said that it would be logical to prepare a gentle transition zone for an average mass of 4.0kg in addition to a child zone for 3.5kg impactors and an adult zone for 4.5kg.
Ms. Brun-Cassan opposed the idea of adding a middle (4.0kg) impactor, and instead proposed a procedure for covering the entire region of the bonnet with one impactor.
Mr. Mizuno agreed that the addition of a middle mass was not practical, and suggested that for the time being they should establish test procedures by two classes of impactors; an adult head and a child head.

Although one opinion was offered to set the lower boundary for the adult zone at 1800mm, the delegates decided that since the peak for accident statistics in Japan is at or near 1700mm, a more pragmatic approach would be to reduce the child stature from the US values when American and Japanese data are combined.
The proposal that 1700mm be set as the child/adult boundary was adopted as a majority opinion.
The delegates also accepted Mr. Lawrence's proposal that an upper boundary for the adult zone be set at 2400mm or a height equal to the top of the windscreen frame.

CONCLUSION 3

For the adult test procedure, two test zone are defined. 1400<WAD<1700 is defined as a transition zone in which both adult and child heads are likely to strike.
A 2400*≧WAD≧1700 is the adult head impact zone. A 900≦WAD≦1400 is the child head impact zone.
**** But not beyond the windscreen frame.***

Mr. Anderson briefly reported the completion of an accident investigation for South Australia. He said that specific data could not be reported pending verification of

the figures. He said death and injury data has already been compiled from 80 cases and that the expected inclusion of 40 more would bring the final total to 120 cases. He added that the data was compiled from several sources including site, contact, and vehicle information, injury sources, and other relevant data.

(a) Test tool
Headform mass & others
The delegates resumed the discussion on headform mass which was postponed the previous day. However, prior to reopening the discussion, the secretary called the delegates attention to ***conclusion 6*** of the previous meeting.
Mr. Ishikawa reported that his group had performed a validation study of computer models before conducting the parameter study by JARI and NHTSA. (IHRA/PS/185)

He said that they improved the GEBOD by adding more flexibility to the spine and bone, and thus providing greater flexibility for the tibia. Trajectory and head velocity were also taken into consideration, and he reported that kinematics of the model for the various front shapes including the streamlined and the old model corresponded closely to those of the cadaver test.

Mr. Ishikawa reiterated his comments of the previous day, stating that effective head mass is greatly influenced by impact conditions such as vehicle shape and stiffness, and the average value of effective head mass approaches the results for head mass itself.
He said the rate of probability should be kept in mind, and he stressed the need to apply an appropriate definition of the concept of average.

Mr. Lawrence, on the contrary, directed the delegate's attention to a notion of "average" related to safety, and said that they have to foresee the consequences associated with each impactor of light mass and heavy mass. He said extreme cases would occur when light mass is used.
The argument could not be resolved and Mr. Mizuno put this issue to a vote among the member countries.

CONCLUSION 4
4.5kg was approved for adult head mass following a vote on the pros-and-cons.

* US: for 4.5kg --- Based on the decision reached at the previous meeting and the simulation reported at this meeting.
* Japan: for 4.5kg --- Based on the decision reached at the previous meeting and the simulation reported at this meeting.
* EU: against 4.5kg --- A notion of average is not appropriate and the simulation was not accurate enough.
* Australia: for 4.5kg if anything --- Based on the decision reached at the previous meeting, but considering the lack of accurate simulation results.

- Moment inertia

In following up on the earlier presentation regarding the moment of inertia for 4.5kg head mass (IHRA/PS/169), Mr. Saul reported that the value specified by EEVC (0.0125±0.001kg-㎡) is about half the value of the cadaver data, and that therefore a review is required.

Mr. Ishikawa supported Mr. Saul's remarks by stating that a value of 0.0239kg-㎡ was reported for adult headforms in study on "the Influence of moment of inertia-child headform impactors" submitted by Japan at the last ISO/TC22/SC10/WG2.

A test of the headform to determine the specific value must be conducted after a thorough investigation is completed on the headform mass and geometric properties.

The delegates agreed to set this as a subject for future study since considerable difficulties are foreseen in conducting such an investigation which would include several other specifications of the headform impactor.

CONCLUSION 5

Moment of inertia specifications

The delegates agreed that every effort should be made to attain values as close as possible to following human values:

Design	*Goals*
Mass	*MOI*
Adult	*4.5kg*	*0.0239kg-m²*
Child	*3.5 kg*	*0.0151kg-m²*

However, it may be difficult to achieve as a particular matter.

The study priorities are; mass, center of gravity, accelerometer placement at the center of gravity, and vibration characteristics. It is also anticipated that moment of inertia may need to be adjusted for particular considerations.

(b) Test procedure

- Computer simulation study result

Mr. Ishikawa briefly introduced the results of computer simulation. (IHRA/PS/185)

He reported that values for head impact speed vs. vehicle impact speed in simulations of a head collision with the bonnet showed different results; JARI showed 0.898 and NHTSA 0.69, while the value for a cadaver was 0.74. Concerning head impact angle, he said that results from JARI and NHTSA simulations are nearly the same at 71 degrees, while 65 degrees was reported for the PMHS (Cadaver test).

Day 3 (Wed. 3 Feb.) Stamford Hotel

Mr. Mizuno proposed that three researchers be assigned to investigate the computer simulation results conducted by JARI and NHTSA, and that their findings, even if incomplete, should be submitted so that simulation results can be reflected in the ESV report in brackets.

The delegates argued over how the simulations should be represented in the test procedures, due to the notable differences in JARI and NHTSA values, and because some of the results are considered unacceptable in spite of similarities in the average values for both JARI and NHTSA.

Mr. Saul and Mr. Ishikawa, who performed the simulation, said that any simulation must be treated as limited and that it is difficult to expect more at this point.

They elaborated by explaining that the differences in the results between JARI and NHTSA may be a reflection of the differences in their models.

They suggested that the simulation should be finalized for the time being, and that the greatest possible use be made of PHMS data.

Regarding the matter of how the simulation is applied to the test method,

Mr. Lawrence drew "matrix lines" showing "head velocity, impact angle, and WAD" values on the vehicle contour which were previously agreed to by the delegates.

He proposed this notion in principle as a guideline of the test method.

He further suggested that delegates choose the best model from those presented by JARI, NHTSA, and RARU, and that a standardized version be adopted so that work can be resumed.
Mr. Lawrence's proposal was unanimously agreed to by the delegates.

CONCLUSION 6

The delegates submitted simulation results as a provisional final for ESV report. Upon receiving ESV approval for continuation of this work program, the delegates will come together and begin validation of model and data analyses.
Mr. Ishikawa offered to provide the model and the data set from JARI required for their analyses.

(c) Criteria, threshold (Adult)
Mr. Mizuno inquired of Mr. Saul as to whether he could obtain a recommendation from the Bio WG with regard to Conclusion 14 (criteria & threshold) reached at the previous meeting. He said that, although Mr. Saul contacted Bio WG, were not able to provide any useful suggestions.
Provisional agreement reached at the previous meeting:

Adult head ---HIC36=1000
---HIC15=700

The delegates reviewed the above provisional agreement reached at the previous meeting.
Mr. Lawrence proposed that "HIC 15 = 700" would be appropriate when it is important to assure short time window contact to avoid a second impact.
However, Mr. Ishikawa countered that the time duration for bonnet contact was generally less than 15 seconds.
Mr. Saul said that "HIC 15= 700" is a standard for airbags,
but that conditions for pedestrians are different and that the first contact could well be short even in the case of window contact.
He concluded his argument with a recommendation for the use of "HIC 15= 1000", which was agreed to by the delegates.

CONCLUSION 7

Although final judgement is the prerogative of the regulatory authorities, the delegates agreed to "HIC15=1000" for all impacts as a consensus WG recommendation.
If there are any mitigating comments or information from the Bio WG, the delegates will reconsider their position.

As a remaining part of the Adult test procedure, Mr. Mizuno asked the delegates for their opinions on whether the draft (IHRA/PS/113R5) should be attached to the 2001 Report.
The delegates decided that everything they has agreed to for every chapter is to be appended to the report in principle.
Mr. Lawrence explained the correction points of the draft (113R5) as compared to Chapter 7 (2001 Report), and proposed to amend Article 3.4 (WAD) to include the items agreed to in the previous day's discussions.

The delegates were divided over the definition and recognition of the transition zone for tests on impact with the bonnet by two types of head impactors. In order to reconfirm the definition of the transition zone in WAD, and the impact test by the two impactors, a pros-and-cons vote was conducted based on the following options.
* Option 1: Test with both headforms within entire transition zone.
* Option 2: Test exclusively with either the adult headform or the child headform within whole transition zone at the discretion of authorities.
* Option3: A boundary will be selected within the transition zone to define the upper limit of the child test area and the lower limit of the adult test area. On the line, both impactors will be used.

Although "Option 1" received considerable support primarily from the viewpoint of safety, Japanese delegates and industry representatives claimed that there should be a boundary line between both the adult and child zones. They further argued that initially two types of headform impactors should be prepared representing the entire test area for both the adult zone and child zone based on accident statistics. They said that an overlapping transition zone is unnecessary and illogical, and that it would be too difficult to obtain measurements that would satisfy the energy absorption of both headform impactors.
Mr. Saul said that this is a harmonized activity, and that it will not necessarily be established as a regulation. He suggested that if the remedial measures present

considerable difficulties for the manufacturers, they might well consider beginning with "Option 3" as Phase 1, and then move to "Option 2" by Phase 2.
He concluded by stating that this argument should be recorded in the Report in detail.

CONCLUSION 8

Option 1 was approved by the following pros-and-cons vote.

**** US: for Option 1***

**** Japan: for Option 2***

**** EU: for Option 1***

**** Australia: for Option 1***

Although non-voting members, ACEA supported Option 3 and JAMA supported Option 2 for reference.

Mr. Mizuno, following Mr. Saul's suggestion, asked the delegates to describe their arguments in the Report.
In addition, following the vote, Mr. Tanahashi said that he had a misapprehension regarding the options, and asked to have his vote changed to Option 3.

Mr. Lawrence suggested that the draft for adult heads (113R5) be amended to apply in principle the concept of vehicle profiles with zones for test conditions that depict head velocity, impact angle, and WAD as a guideline for test methods.
He suggested as an example, the use of 3 vehicle categories by 3 speeds (total 9 cases), which could be further subdivide if more categories are required.
Mr. Saul stated his assumption that it would be difficult to depict the test conditions as a guideline on the vehicle profile, since the orientation, speed, and angle of impact are influenced by the form of the car according to simulation results.
Mr. Tanahashi also expressed concern that the introduction of overlapping zones would greatly complicate the guidelines.
The delegates agreed to the matrix proposed by Mr. Lawrence.
Mr. Lawrence will refine his proposal and submit a guideline by the next meeting.

CONCLUSION 9

Mr. Lawrence will propose a matrix which depicts test conditions on the vehicle profile by the next meeting.

The delegates agreed to inform JASIC in advance by e-mail etc., of any recommendations they may have.

3. Child head test procedure

The delegates agreed to proceed with a test methods for the child head that are as same as those for adults, and to further discuss the remaining parts of the test procedures.

(1) Computer simulation

Mr. Ishikawa reported that JARI presented the analysis on the effective mass, angle and other important parameters at the previous meeting.

Mr. Saul raised the question of how the model is to be validated. Mr. Ishikawa replied that there is no validation data available, but that the model has been scaled down.

Mr. Lawrence argued that rather than a mere scale down, it was necessary to take into consideration the child's flexibility of spine, more flexible elements or hinges in case of impact, and other key factors.

Mr. Ishikawa said that the validation level for the child model depends on such parameters as information regarding head impact velocity, impact angle, and effective mass. The delegates agreed that a scaling down would be effective, assuming the inclusion of these parameters.

(2) Criteria, threshold

With regard to the Criteria and threshold for a child, "HIC 15= 1000" is deemed realistic just as for an adult.

CONCLUSION 10

From a practical perspective regarding criteria and threshold for a child, the delegates agreed to adopt "HIC 15= 1000" the same as for an adult.

Although Mr. Ishikawa proposed that the tolerance of the value for the moment of inertia be corrected in the draft for child head (IHRA/PS/110R1), the delegates agreed to adhere to ***conclusion 5***.

4. Leg (knee & lower leg) test procedure

Mr. Mizuno asked for section by section comments on the test procedures for the leg. (IHRA/PS/119) Mr. Lawrence suggested removing the terms thigh and femur from the draft title.
The scope of this test method was determined only for knee and leg.
The delegates agreed not to enter this test method in the 2001 Report, since discussion on all aspects of the subject has not yet been conducted.

Mr. Ishikawa reported that JARI was engaged in the three following projects so that they can submit the report to the next ESV conference.
①Cadaver tests to obtain bio mechanical response data, and observation of the bio fidelity in the current TRL legform impactor. JARI proposed two impact response corridors at last year's IRCOBI conference (40km/h high speed and 20km/h low speed)
Methods to determine the transfer function between mechanical TRL legform impactors and human like legforms are being studied. The results will be summarized for presentation at the next ESV conference.
②A study of the influence of tibia flexibility in relation to the knee joint, using a human like knee joint model in co-operation with Honda.
③Development of a human like legform impactor, making use of that used for the Honda polar dummy.
Mr. Ishikawa submitted the bio mechanical response data on condition that JAMA allows them to release the related data and update the draft, since these studies are funded by JAMA.
Mr. Mizuno asked delegates to evaluate the existing impactor based on the updated bio mechanical data that will be provided by JARI.
Mr. Ishikawa said that his group has made some progress in the evaluation, but requested that Mr. McLean continue the reconstruction study in Australia.
Mr. McLean agreed to his proposal.

CONCLUSION 11

The delegates agreed to further discuss corrections or new developments regarding the impactor following the results of the evaluation.

7. Input by OICA in car feasibility

Mr. Mizuno requested that the OICA or the industry work out a unified opinion concerning the car feasibility data for the 2001 Report.

8. Next meeting

The next IHRA delegates meeting is tentatively scheduled to be held in Tokyo for 3 days during the week of May 6, 2001.

A discussion on the fourth day concerning the 2001 Report is omitted.

Appendix 1

Attendees at IHRA Pedestrian Safety WG 8h Meeting, February 5-8, 2001

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